

PATENT COOPERATION TREATY

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From the:
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

Freehills Patent & Trade Mark Attorneys
Level 43
101 Collins Street
MELBOURNE VIC 3000

24 FEB 2006
Updated by: [Signature]
Date: [Signature]

PCT

NOTIFICATION OF TRANSMITTAL OF
INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Rule 71.1)

Date of mailing
(day/month/year) 23 FEB 2006

Applicant's or agent's file reference

M80789771:DLT:NAW:ap

IMPORTANT NOTIFICATION

International application No.

PCT/AU2004/001633

International filing date (day/month/year)

24 November 2004

Priority date (day/month/year)

24 November 2003

Applicant

AGRICULTURE VICTORIA SERVICES PTY LTD et al

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary report on patentability and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translations to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the *PCT Applicant's Guide*.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed invention is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the IPEA/AU

AUSTRALIAN PATENT OFFICE
PO BOX 200, WODEN ACT 2606, AUSTRALIA
E-mail address: pct@ipaustalia.gov.au
Facsimile No. (02) 6285 3929

Authorized officer

JAMIE TURNER

Telephone No. (02) 6283 2071

PATENT COOPERATION TREATY
PCT
INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference M80789771:DLT:NAW:ap	FOR FURTHER ACTION	See Form PCT/IPEA/416
International application No. PCT/AU2004/001633	International filing date (<i>day/month/year</i>) 24 November 2004	Priority date (<i>day/month/year</i>) 24 November 2003
International Patent Classification (IPC) or national classification and IPC Int. Cl. C12N 15/29 (2006.01) C07K 14/415 (2006.01)		
Applicant AGRICULTURE VICTORIA SERVICES PTY LTD et al		

This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

a. ☒ (*sent to the applicant and to the International Bureau*) a total of 4 sheets, as follows:

☐ sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

b. ☐ (*sent to the International Bureau only*) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or table related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒ Box No. I Basis of the report

☐ Box No. II Priority

☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

☐ Box No. IV Lack of unity of invention

☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

☐ Box No. VI Certain documents cited

☐ Box No. VII Certain defects in the international application

☒ Box No. VIII Certain observations on the international application

Date of submission of the demand 26 September 2005	Date of completion of this report 20 February 2006
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer JAMIE TURNER Telephone No. (02) 6283

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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Box No. I Basis of the report

1. With regard to the language, this report is based on:
- ☒ The international application in the language in which it was filed
- ☐ A translation of the international application into _____, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3(a) and 23.1 (b))
- ☐ publication of the international application (under Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))
2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:
- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1-44 as originally filed/furnished
- pages* received by this Authority on _____ with the letter of
- pages* received by this Authority on _____ with the letter of
- ☒ the claims:
- pages as originally filed/furnished
- pages* as amended (together with any statement) under Article 19
- pages* 45-48 received by this Authority on 26 September 2005 with the letter of 26 September 2005
- pages* received by this Authority on _____ with the letter of
- ☒ the drawings:
- pages 1/108 - 108/108 as originally filed/furnished
- pages* received by this Authority on _____ with the letter of
- pages* received by this Authority on _____ with the letter of
- ☒ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.
3. ☒ The amendments have resulted in the cancellation of:
- ☐ the description, pages
- ☒ the claims, Nos. 27, 28
- ☐ the drawings, sheets/figs
- ☐ the sequence listing *(specify)*:
- ☐ any table(s) related to the sequence listing *(specify)*:
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing *(specify)*:
- ☐ any table(s) related to the sequence listing *(specify)*:

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims 1-26	YES
	Claims	NO
Inventive step (IS)	Claims 1-26	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-26	YES
	Claims	NO

2. Citations and explanations (Rule 70.7)

The following documents are relevant to this international application:

- D1 – KUIPER, MJ et al. (2001) Biophysical Journal 81: 3560-5
D2 – PUDNEY, PD et al. (15 February 2003) Archives of Biochemistry and Biophysics 410: 238-45
D3 – EMBL Accession No AJ277399.1 (29 April 2000) SIDEBOTTOM, CM
D4 – WO 2004/022700
D5 – GIDEKEL, M et al. (2 September 2003) Extremophiles 7:459-69

Each of D1-D4 discloses polynucleotide and polypeptide sequences of an antifreeze peptide from *Lolium perenne*, but no prior sequence discloses nucleotides as shown in Figures 26, 27, 29 and 30. Therefore the claims are novel and inventive in view of any of D1-D4.

While D5 discusses three cold acclimatisation-responsive genes, and their corresponding polypeptides from *Deschampsia antarctica*, D5 does not disclose the antifreeze proteins of the present specification. Therefore the claims referring to *Deschampsia antarctica* are novel and inventive in view of D5

The claimed matter appears to possess Industrial Applicability.

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Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

The claims are not fully supported for those claims that specify a "variant thereof". Such a term is broad and largely unsupported except to the extent that the claimed polypeptides have the same biological activity as the regulatory elements and ice recrystallisation protein. This applies to the claimed polynucleotides encoding the same.

Supplemental Box Relating to Sequence Listing

Continuation of Box No. I, item 2:

1. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this report was established on the basis of:
 - a. type of material
 - ☒ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material
 - ☒ on paper
 - ☒ in electronic form
 - c. time of filing/furnishing
 - ☒ contained in the international application as filed
 - ☒ filed together with the international application in electronic form
 - ☐ furnished subsequently to this Authority for the purposes of search and/or examination
 - ☐ received by this Authority as an amendment* on
2. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
3. Additional comments:

* If item 4 in Box No. I applies, the listing and/or table(s) related thereto, which form part of the basis of the report, may be marked "superseded."

CLAIMS

1. A substantially purified or isolated nucleic acid or nucleic acid fragment encoding an ice recrystallisation inhibition protein (IRIP) from a *Deschampsia* species, or a functionally active fragment or variant thereof.
- 5 2. A nucleic acid or nucleic acid fragment according to claim 1 wherein said *Deschampsia* species is *Deschampsia antarctica*.
3. A nucleic acid or nucleic acid fragment according to claim 1 or 2 including a nucleotide sequence selected from the group consisting of (a) sequence shown in Figures 8, 9, 11, 12, 14, 15, 17, 18, 20, 21, 23 and 24 hereto; (b) complements of the
10 sequences recited in (a); (c) sequences antisense to the sequences recited in (a) and (b); (d) functionally active fragments and variants of the sequences recited in (a), (b) and (c); and (e) RNA sequences corresponding to the sequences recited in (a), (b), (c) and (d).
4. A substantially purified or isolated nucleic acid or nucleic acid fragment encoding
15 an IRIP from a *Festuca* species, or a functionally active fragment or variant thereof.
5. A substantially purified or isolated nucleic acid or nucleic acid fragment encoding an IRIP including a nucleotide sequence selected from the group consisting of (a) sequences shown in Figures 26, 27, 29 and 30 hereto; (b) complements of the sequences recited in (a); (c) sequences antisense to the sequences recited in (a) and
20 (b); (d) functionally active fragments and variants of the sequences recited in (a), (b) and (c); and (e) RNA sequences corresponding to the sequences recited in (a), (b), (c) and (d).
6. A substantially purified or isolated regulatory element from an IRIP nucleic acid from a *Deschampsia* species, or a functionally active fragment or variant thereof.
- 25 7. A regulatory element according to claim 6 including a nucleotide sequence selected from the group consisting of (a) sequences shown in Figures 32 and 33 hereto;

(b) complements of the sequences recited in (a); and (c) functionally active fragments and variants of the sequences recited in (a) and (b).

8. A substantially purified or isolated regulatory element from an IRIP nucleic acid from a *Lolium* or *Festuca* species, or a functionally active fragment or variant thereof.

5 9. A regulatory element according to claim 8 including a nucleotide sequence selected from the group consisting of (a) sequence shown in Figure 34 hereto; (b) complement of the sequence recited in (a) and (c) functionally active fragments and variants of the sequences recited in (a) and (b).

10 10. A construct including one or more nucleic acids or nucleic acid fragments according to any one of claims 1 to 5.

11. A construct according to claim 10 being a vector and further including one or more promoters and one or more terminators, said nucleic acids or nucleic acid fragments, promoters and terminators being operatively linked.

15 12. A construct including one or more regulatory elements according to any one of claims 6 to 9.

13. A construct according to claim 12 being a vector and further including one or more further nucleic acid molecules capable of modifying plant response to freezing and/or low temperature stress, and one or more terminators, said regulatory elements, further nucleic acids and terminators being operatively linked.

20 14. A construct according to claim 13 wherein said further nucleic acid molecule is a nucleic acid or nucleic acid fragment according to any one of claims 1 to 5.

15. A plant cell, plant, plant seed or other plant part, including a construct according to any one of claims 10 to 14.

25 16. A plant, plant seed or other plant part derived from a plant cell or plant according to claim 15.

17. A method of modifying tolerance of freezing and/or low temperature stress in a plant, said method including introducing into said plant an effective amount of a nucleic acid or nucleic acid fragment according to any one of claims 1 to 5, or a construct according to any one of claims 10 to 14:
- 5 18. Use of a nucleic acid or nucleic acid fragment according to any one of claims 1 to 5, and/or nucleotide sequence information thereof, and/or single nucleotide polymorphisms thereof as a molecular genetic marker.
- 10 19. A substantially purified or isolated nucleic acid or nucleic acid fragment including a single nucleotide polymorphism (SNP) from a nucleic acid fragment according to any one of claims 1 to 5.
20. A substantially purified or isolated IRIP or IRIP-like polypeptide from a *Deschampsia* species, or a functionally active fragment or variant thereof.
21. A polypeptide according to claim 20 wherein said *Deschampsia* species is *Deschampsia antarctica*.
- 15 22. A polypeptide according to claim 20 or 21 including an amino acid sequence selected from the group consisting of sequences shown in Figures 10, 13, 16, 19, 22 and 25 hereto; and functionally active fragments and variants thereof.
23. A substantially purified or isolated IRIP or IRIP-like polypeptide from a *Festuca* species; or a functionally active fragment or variant thereof.
- 20 24. A substantially purified or isolated IRIP or IRIP-like polypeptide including an amino acid sequence selected from the group consisting of sequences shown in Figures 28 and 31 hereto; and functionally active fragments and variants thereof.
25. A polypeptide encoded by a nucleic acid or nucleic acid fragment according to any one of claims 1 to 5.

26. A preparation for transforming a plant comprising a nucleic acid or nucleic acid fragment according to any one of claims 1 to 5, or a construct according to any one of claims 10 to 14.

INTERNATIONAL SEARCH REPORT

 International application No.
 PCT/AU2004/001633

A. CLASSIFICATION OF SUBJECT MATTER Int. Cl. 7: - C12N 15/29, C07K 14/415 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) SEE ELECTRONIC DATABASES BELOW. Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched SEE ELECTRONIC DATABASES BELOW. Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPIDS, MEDLINE, Caplus, AGRICOLA, BIOSIS, EMBL, SWISSPROT : deschampsia, festuca, lolium, antifreeze, ice recrystallisation, SEQ ID 128, SEQ ID 102, SEQ ID 17.		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KUIPER, M. J., et. al. (2001) A Theoretical Model of a Plant Antifreeze Protein from <i>Lolium perenne</i> . Biophysical Journal 81:3560-5. (see Abstract, Table 1 and Figures 2 and 3)	4-6, 9-15, 24-27.
X	PUDNEY, P. D. A., et. al. (15 February 2003) The Physico-chemical characterization of a boiling stable antifreeze protein from a perennial grass (<i>Lolium perenne</i>). Archives of Biochemistry and Biophysics 410:238-45. (see Abstract, and Materials and Methods)	4-6, 9-15, 24-27.
X	EMBL Accession number AJ277399.1 (29-APR-2000). <i>Lolium perenne</i> partial mRNA for ice recrystallisation inhibition protein. Sidebottom, C.M.	4-6, 9-15, 24-27.
P,X	WO 2004/022700 A2 (GENESIS RESEARCH AND DEVELOPMENT CORPORATION LIMITED et. al.) 18 March 2004	4-6, 9-20, 24-27.
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family	
Date of the actual completion of the international search 5 January 2005		Date of mailing of the international search report 21 JAN 2005
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No. (02) 6285 3929		Authorized officer ALISTAIR BESTOW Telephone No : (02) 6283 2450

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2004/001633

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	ATICI, Ö., et. al. (Dec. 2003) Antifreeze proteins in Higher Plants. <i>Phytochemistry</i> 64:1187-96. (see Fig. 5)	4-6, 9-15, 24-27.
A	GIDEKEL, M., et. al. (2 September 2003) Identification and characterisation of three novel cold acclimation-responsive genes from the extremophile hair grass <i>Deschampsia antarctica</i> Desv. <i>Extremophiles</i> 7:459-69.	1-3, 7-8, 21-23, 27.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2004/001633

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member	
WO	2004022700	US	2004146884
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.			
END OF ANNEX			